



GTX/GTX LTR/LTS 2000™

Portable Radios
Service Manual

Foreword

The information contained in this manual relates to all GTX/GTX LTR/LTS 2000™ radios, unless otherwise specified.

Safety Information

Airbag Warning Statement



VEHICLES EQUIPPED WITH AIR BAGS

An air bag inflates with great force. DO NOT place objects, including communication equipment, in the area over the air bag or in the air bag deployment area. If the communication equipment is improperly installed and the air bag inflates, this could cause serious injury.

- Installation of vehicle communication equipment should be performed by a professional installer/technician qualified in the requirements for such installations. An air bag's size, shape and deployment area can vary by vehicle make, model and front compartment configuration (e.g., bench seat vs. bucket seats).
- Contact the vehicle manufacturer's corporate headquarters, if necessary, for specific air bag information for the vehicle make, model and front compartment configuration involved in your communication equipment installation.

FCC Safety Information

The Federal Communications Commission (FCC), with its action in General Docket 79-144, March 13, 1985, has adopted a safety standard for human exposure to radio frequency (RF) electromagnetic energy emitted by FCC-regulated equipment. Motorola subscribes to the same safety standard for the use of its products. Proper operation of this radio will result in user exposure substantially below FCC recommended limits.

- DO NOT hold the radio with the antenna very close to, or touching, exposed parts of the body, especially the face, ears, or eyes, while transmitting. Hold the radio in a vertical position with the microphone two to three inches away from the lips.
- DO NOT hold the transmit switch (PTT) on when not actually desiring to transmit.
- DO NOT allow children to play with any radio equipment containing a transmitter.
- DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere. Under certain conditions, radios can interfere with blasting operations. When you are in the vicinity of construction work, look for, and observe, signs cautioning against radio transmissions. If radio transmission is prohibited, you must not transmit until out of the area. Furthermore, you must turn off your radio to prevent any accidental transmission.
- DO NOT replace or charge batteries in a hazardous atmosphere. Contact sparking may occur while installing or removing batteries and cause an explosion.
- Turn the radio off when removing or installing a battery.

Anyone intending to use a radio in a hazardous area is advised to become familiar with the subject of intrinsic safety and with Section 70 of the National Fire Code, which is commonly referred to as Article 500 of the National Electric Code. Use of anything but factory supplied components may affect the approval and safety of the radio. Likewise, it is advised that servicing should be performed only by qualified personnel who adhere to the following Factory Mutual (FM) required warning:



Modification of FM approved intrinsically safe radios will negate Factory Mutual Research Corporation (FMRC) approval.

Manual Revisions

Changes which occur after this manual is printed are described in "FMRs." These FMRs provide complete information on changes including pertinent parts listing data.

Computer Software Copyrights

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GTX and GTX LTR Portable Radios Model Chart

GTX Portable Radio, H11WCD4CB1AN: GTX LTR Portable Radio, H11WCD4CU1AN

FUF1194	900 MHz 1.5 ppm GTX Portable Radio
FUF1199	900 MHz 1.5 ppm GTX LTR Portable Radio
HNN9628	Battery (7.5 V rechargeable)
NAF5038	1/2 Wavelength Whip 900 MHz

KIT BREAKDOWN

FUF1194 900 MHz 1.5 ppm Portable Radio: FUF1199 900 MHz 1.5 ppm GTX LTR Portable Radio:

FLN2436	Front Unit
FUF1196	1.5 ppm RF Unit
FLN8577	Miscellaneous Parts

FLN2436 Front Housing

FHN5873	Housing
FEN1650	Logic Board & I/O Unit
FSN5509	Speaker & Microphone Assembly
FLN8574	Miscellaneous Parts

FEN1650 Logic Board & I/O Unit

FLN8836	Logic Board
FLN8515	I/O Hardware

FUF1196 1.5 ppm RF Unit

FUF5690	1.5 ppm RF Board
FLN2394	Chassis Assembly
FLN8575	Shield & Parts

FLN2394 Chassis Assembly

FLN8517	Battery Filter Board
FLN8518	Chassis Hardware

Not all kits on this page will be available from the Americas Parts Division

LTS 2000 Portable Radio Model Chart

LTS 2000 Portable Radio, H10WCH4DC5AN

FUF1195	900 MHz, 1.5 ppm Portable Radio
HNN9628	Battery (7.5 V rechargeable)
HLN8255	Belt Clip
NAF5038	1/2 Wavelength Whip 900 MHz

KIT BREAKDOWN

FUF1195 900 MHz, 1.5 ppm Portable Radio

FLN2437	Front Unit
FUF1196	1.5 ppm RF Unit
FLN8665	Miscellaneous Parts

FLN2437 Front Housing

FHN5874	Housing
FEN1651	Logic Board & I/O Unit
FSN5509	Speaker & Microphone Assembly
FLN8576	Miscellaneous Parts

FEN1651 Logic Board & I/O Unit

FLN8836	Logic Board
FLN8515	I/O Hardware

FUF1196 1.5 ppm RF Unit

FUF5690	1.5 ppm RF Board
FLN2394	Chassis Assembly
FLN8575	Shield & Parts

FLN2394 Chassis Assembly

FLN8517	Battery Filter Board
FLN8518	Chassis Hardware

Not all kits on this page will be available from the Americas Parts Division

GTx/GTX LTR/LTS 2000 Options

Model	GTx/GTX LTR	LTS 2000	GTx/LTR/LTS 2000 Options			
			Option	Description		
Factory Mutual (FM) Batteries						
X	X	H236	Fully Approved Factory Mutual Intrinsically Safe Radio (includes FA 1200 mAH battery)			
X	X	H73	Factory Mutual Intrinsically Safe Radio (includes 600 mAH battery)			
X	X	H224	600 mAH Slim Battery (deletes standard battery)			
Antenna						
X	X	H112	Delete Standard Antenna			
Miscellaneous						
X	X	H415	Bulk Packaging (minimum 10 units per line item)			
Chargers						
X		H951	Delete Standard Charger			
X		H437	Rapid Rate Charger, 110 V			
X		H438	Slow Rate Charger, 220 V			
X		H439	Rapid Rate Charger, 220 V			

GTX/GTX LTR/LTS 2000 Accessories

Model	GTX/GTX LTR	LTS 2000	GTX/GTX LTR/LTS 2000 Accessories	
			Accessory	Description
Charger Pick-ups				
	X	HTN9803	Single Unit, Rapid Charger, UK Plug, 240 V	
X	X	HTN9702	Single Unit Standard Charger, 110 V	
X	X	HTN9630	Single Unit, Rapid Charger, 110 V	
X	X	HTN9812	Multiple Unit, Rapid Charger, 220 V	
X	X	HTN9719	Vehicular Charger, Adapter/Bracket, 12 V for use with single unit rapid chargers	
X	X	HTN9811	Multiple Unit, Rapid Charger, European Plug, 220 V	
X	X	HTN9944	Wall Mounting Bracket for Multiple Unit Chargers	
Antenna Pick-ups				
X	X	NAF5042	806-941 MHz 1/4 Wavelength Whip	
X	X	NAF5039	900 MHz 1/2 Wavelength Whip	
Battery Pick-ups				
X	X	HNN9628	1200 mAh High Capacity Battery	
X	X	HNN9701	1200 mAh Fully Approved Factory Mutual Battery*	
X	X	HNN8308	600 mAh Slimline Battery	
X	X	HNN9808	600 mAh Fully Approved Factory Mutual Slim Battery*	
Carrying Accessories Pick-ups				
X	X	HLN9750	Nylon Belt Loop Carry Case for High Capacity Battery	
X	X	HLN9421	DTMF Standard Leather Carry Case w/Swivel	
X	X	HLN9426	DTMF Standard Leather Carry Case w/Swivel for Fully Approved FM 1200 mAH	
X	X	HLN9427	DTMF Standard Leather Carry Case w/Swivel for Fully Approved FM 600 mAH	
X	X	HLN9429	DTMF Standard Leather Carry Case w/Belt Loop for Fully Approved FM 1200 mAH	
X	X	HLN9431	DTMF Standard Leather Carry Case w/Belt Loop for Fully Approved FM 600 mAH	
X	X	HLN9076	Standard Molded Carry Holder with Belt Clip	
X	X	HLN9149	Swivel Belt Loop Adapter for Use w/Carry Cases HLN9750	
X	X	HLN9724	Belt Clip	
X	X	TDN1002	Swiveller - includes holster, belt and strap	
	X	HLN8255	Spring Belt Clip	
X	X	NTN5243	Shoulder Strap (for use with all Carry Cases)	
Audio/RF Accessories:				
X	X	HMN9725	Remote Speaker Microphone w/Coil Cord and Clip Back	
X	X	HMN9727	Earpiece without Volume Control	
X	X	HMN9752	Earpiece with Volume Control	
	X	HMN9754	2-Piece Surveillance Microphone, PTT and Microphone are combined in 1 Piece	
X	X	BDN6720	Ear Receiver with /GP300 Style Connector	
X	X	FLN8660	Audio Accessory Security Clamp	

*These batteries are only compatible with portables ordered from the factory with the Factory Mutual option.

Model	GTX/GTX LTR	LTS 2000	GTX/GTX LTR/LTS 2000 Accessories (cont.)		
		Documentation Kits			
X		68P02946C80-A	GTX Portable Radio User's Guide		
	X	68P02948C65-O	GTX LTR Portable Radio User's Guide		
X	X	68P02948C90-O	GTX/GTX LTR/LCS 2000 Portable Radios Service Manual		
		Radio Service Software (RSS)*			
X		RVN4150B	RSS Package for GTX and GTX LTR Radio Programming		
	X	RVN4156B	RSS Package for LCS/LTS 2000 Radio Programming		
X	X	68P02946C20-A	LCS/LTS 2000 RSS User's Guide		
X	X	68P02948C70-O	GTX/GTX LTR RSS User's Guide		
X	X	HKN9857	Programming/Test Cable		

* See RSS information for hardware details.

Prices and availability subject to change without notice

Performance Specifications: GTX/GTX LTR/LTS 2000

Performance Specifications: GTX/GTX LTR/LTS 2000

GENERAL		RECEIVER		TRANSMITTER	
FCC Designation:	AZ489FT5781	Frequency Range:	935-941 MHz	RF Power:	2.5 W
Power Supply:	NiCad Battery	Bandwidth	6 MHz	Frequency range:	896-902 MHz 935-941 MHz
Battery Voltage: Nominal: Range:	7.5 V 6 to 9 V	Usable Sensitivity (12 dB SINAD):	0.35 μ V max.	Freq. Stability (-30+60°C; 25°C ref.):	\pm 0.00015%
Battery Drain, Typical: Standby: Receive: Transmit:	68 mA 195 mA 1500 mA	Intermodulation:	-60 dB	Emission (Conducted and Radiated):	-47 dBc
Temperature Range: Operating: Storage:	-30+60°C* -40+85°C	Selectivity (12.5 kHz Adjacent Channel):	-60 dB	FM Hum and Noise (Companion Receiver):	-35 dB
Dimensions (H x W x D) GTX (total height includes radio, antenna adaptor, and antenna)	12.86x2.32x1.09" 325.53 x 59 x 29.8 mm	Spurious Rejection:	-60 dB	Distortion:	5%
LTS 2000 (total height includes radio, antenna adapter, and antenna)	12.86x2.32x1.17" 326.53 x 59 x 29.8 mm				
Weight (w/Antenna): GTX less Battery:	0.69 lbs (314 gr)	Freq. Stability: (-30+60°C; 25°C ref.)	\pm 0.00015%	Modulation Limiting:	2.5 kHz
GTX + Standard Battery:	1.20 lbs (544 gr)				
GTX + HNN9701 Battery	1.38 lbs (625 gr)				
LTS 2000 less Battery:	0.68 lbs (310 gr)				
LTS 2000 + Standard Battery:	1.19 lbs (540 gr)				
LTS 2000 + HNN9701 Battery:	1.37 lbs (621 gr)				
	Rated Audio:	500 mW	Recommended Battery:	HNN9628 NTN7143	
	Distortion (At Rated Audio):	5%			
	Channel Spacing	12.5 kHz			

* Operating for Display: -20+60°C

All specifications subject to change without notice

Service Aids

The following table lists service aids recommended for working on the GTX/GTX LTR/LTS 2000.

MOTOROLA NO.	DESCRIPTION	APPLICATION
RLN4008	Radio Interface Box	Enables communication between the radio and the computer's serial communications adapter.
0180357A57 (120 Vac) 0180358A56 (220 Vac)	RIB Power Supply	Used to supply power to the RIB.
30-80369B72 for IBM PC ATs, or 30-80369B71 for all other IBM PCs	Computer Interface Cable	Connects the computer's serial communications adapter to the RIB.
RLN4438	AT to XT Computer Adapter	Allows 30-80369B72 to plug into a XT style communications port.
HKN9857	Programming / Test Cable	Connects radio to RIB. And can be used as a Battery Eliminator.
RVN4150B for GTX/LTR RVN4156B for LTS 2000	Radio Service Software	Software on 3-1/2 in. and 5-1/4 in. floppy disc.
RTX4005	Portable Test Set	Enables connection to the audio/accessory jack. Allows switching for radio testing.
RKN4034	Test Set Cable	Connects radio to RTX4005B Test Box.
FLN8769	Tune and Test Fixture	Enables board level maintenance
5880348B33	SMA Female to BNC Female Adapter	Enables RF connection to radio antenna connector.
RLN4460	Test Box. Must be ordered with 0180303E49 adaptor assembly.	Enables connection to the audio/accessory jack. Allows switching for radio testing.

Test Equipment

The following table lists test equipment required to service the GTX/GTX LTR/LTS 2000.

MOTOROLA NO.	DESCRIPTION	CHARACTERISTICS	APPLICATION
R2000, R2400, or R2001D with trunking option	Communications System Analyzer	This monitor will substitute for items with an asterisk *	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
*R1049A	Digital Multimeter		Two meters recommended for AC/DC voltage and current measurements
*S1100A	Audio Oscillator	67 to 161.4Hz tones	Used with service monitor for injection of PL tones
*S1053D, *SKN6009A, *SKN6001A	AC Voltmeter, Power Cable for meter, Test leads for meter	1 mV to 300 V, 10-Megohm input impedance	Audio voltage measurements
R1053	Dual-trace Oscilloscope	20 MHz bandwidth, 5 mV/cm - 20 V/cm	Waveform measurements
*S1350C, *ST1215B (VHF) *ST1223B (UHF) *T1013A	Wattmeter, Plug-in Elements (VHF & UHF), RF Dummy Load	50-Ohm, \pm 5% accuracy 10 W, max. 0-1000 MHz, 300 W	Transmitter power output measurements
S1339A	RF Millivolt Meter	100 μ V to 3 VRF, 10 KHz to 1.2 GHz	RF level measurements
*R1013A	SINAD Meter		Receiver sensitivity
S1347D or S1348D (prog)	DC Power Supply	0-20 Vdc, 0-5 Amps	Bench supply for 10Vdc

Service Tools

The following table lists the tools recommended for working on this family of radios; these tools are also available from Motorola. Note that the R-1319A workstation requires the use of a specific "heat focus head" for each of the components on which this item is used. Each of these heat focus heads must be ordered separately. The individual heat focus heads (and the components on which they are used) are listed at the top of the next page.

MOTOROLA NO.	DESCRIPTION	APPLICATION
6680387A59	Extractor, 2-contact	Removal of discrete surface-mounted devices.
6680387A64	Heat controller with safety stand, or	
6680387A65	Safety stand only	
0180381B45 110 Vac or 0180300E06 220 Vac	MBT250 Surface-mount/ thru-hole repair station	Temperature-controlled, self-contained soldering/desoldering repair station for installation and removal of surface-mounted devices.
8180369E97	Flux holder/applicator arrays for repair.	Allows for the proper amount of flux to be applied to pad grid.
1105139W02	30cc plastic syringe and flux paste	For use with flux holder/applicator 8180369E97.
0180386A81	Miniature digital readout soldering station (incl. 1/64" micropoint tip)	
0180386A78	Illuminated magnifying glass with lens attachment	
0180386A82	Anti-static grounding kit	Used during all radio assembly and disassembly procedures.
6684253C72	Straight prober	
6680384A98	Brush	
1010041A86	Solder (RMA type), 63/37, 0.020" diameter 1 lb. spool	
1080370B43	RMA liquid flux	
R-1319A	Shields and surface-mounted component - IC removal/rework station (order all heat focus heads separately)	Removal of surface-mounted integrated circuits.

HEAT-FOCUS HEADS	INSIDE DIMENSIONS OF HEADS	USED ON	MAXIMUM PRESCRIBED HEAT SETTING
6680334B52	0.572" x 0.572"	U701	Refer to Maintenance Section of Manual for prescribed heat setting.
6680371B15	0.460" x 0.560"	VCO shield SH260	

Test Set Service Cable

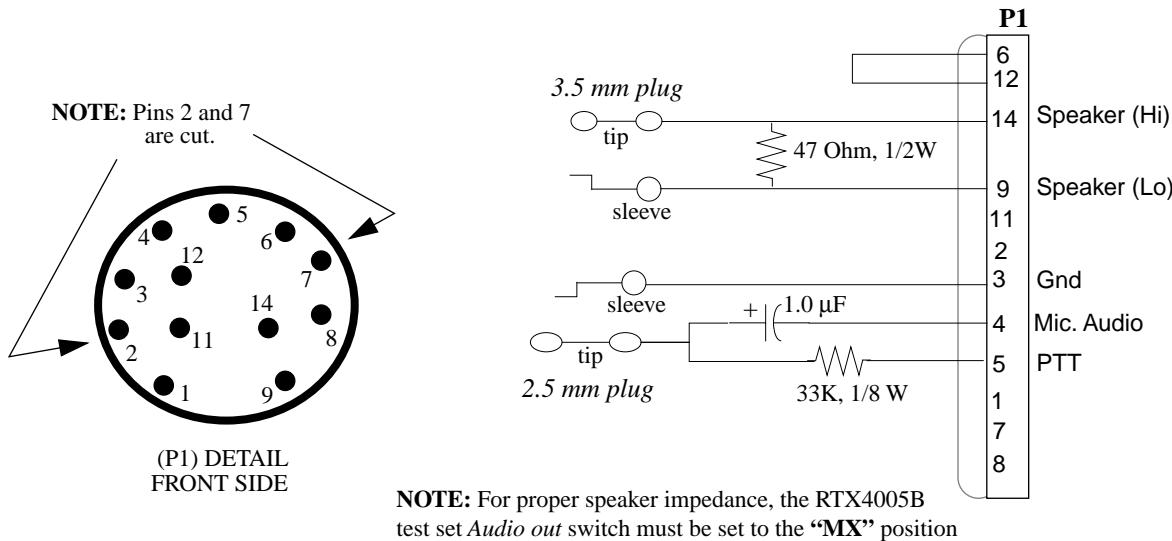


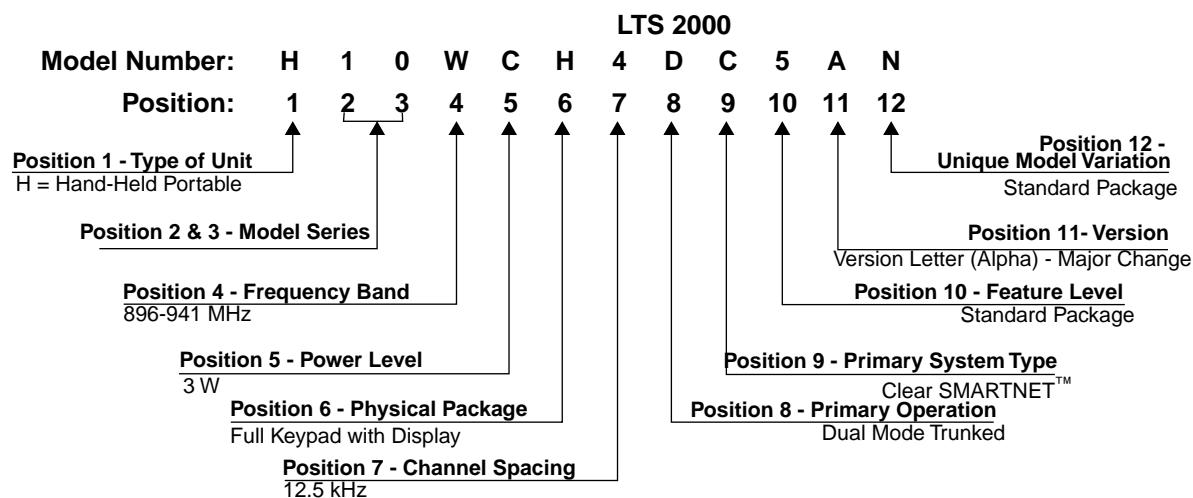
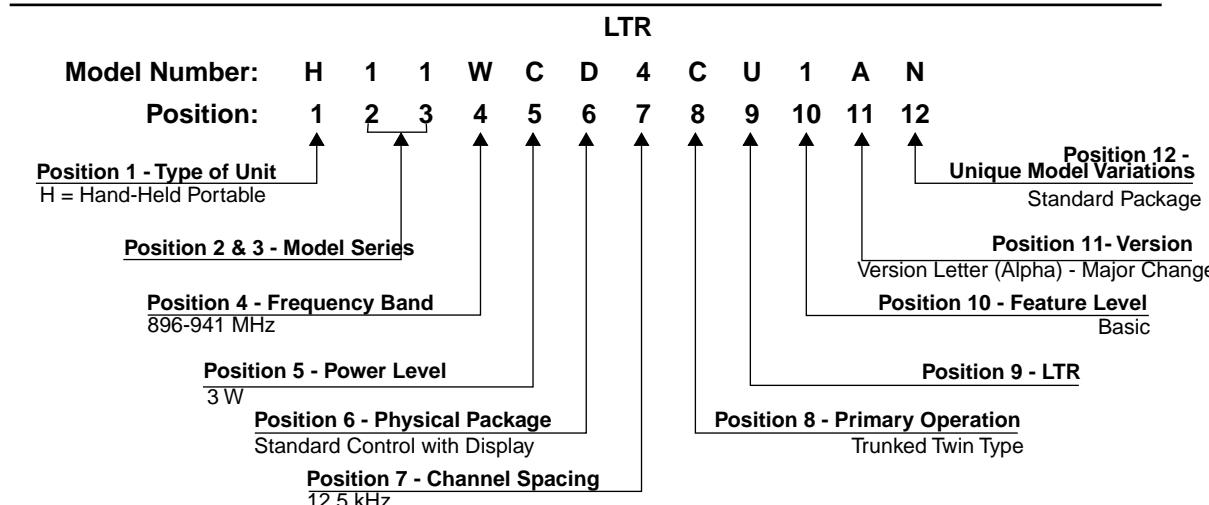
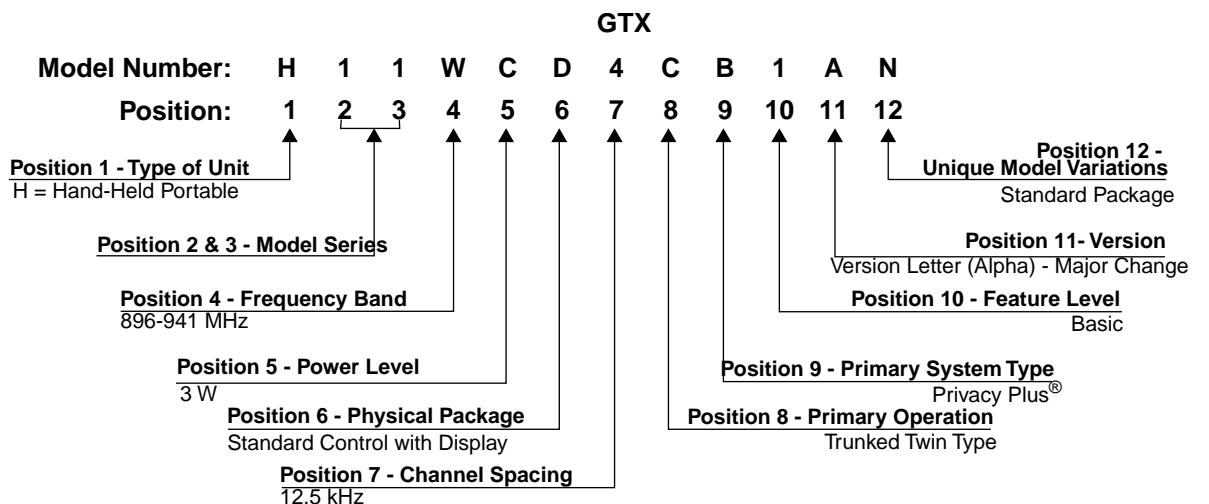
Figure 1. Service Cable (RKN4034A) for the Test Set (RTX4005B)

Radio Model Numbering System

Radio Model Numbering System

The model number, serial number, and Motorola FCC designation number are all on a label attached to the back of your radio.

All GTX/GTXLTR/LTS 2000 radio models are synthesized, 8-channel units that come standard with Tone Private-Line (TPL)/Digital Private-Line (DPL) coded squelch or carrier squelch, which may be enabled/disabled on a per channel basis. Programming changes can be made by your local dealer.



Radio Service Software Information

To run the Radio Service Software, you will need the following equipment:

Required Equipment:

1. *IBM XT, AT, Convertible, or System/2 Model 30/50TM with 512K RAM, Dual Floppy Disk Drives or one Floppy Disk and one Hard Disk.*
2. *PC DOSTM or MS-DOSTM 3.0 or later.*
3. **Radio Interface Box (RIB) RLN4008.**
4. **RIB to IBM AT cable 30-80369B72.**
5. *IBM AT cable to IBM XT computer adapter (optional) RLN4438.*
6. **Programming/Test cable.**
7. **RIB power supply 0180357A57 (120 Vac) or 0180358A56 (220 Vac).**

**0180357A57 (120 Vac) or
0180358A56 (220 Vac)**

RIB Power Supply.

Plugs into 120 or 220 Vac outlet.



**30-80369B72 or
30-80369B71**

RIB to Computer Cable.

Plugs into RIB and computer.

15 PIN

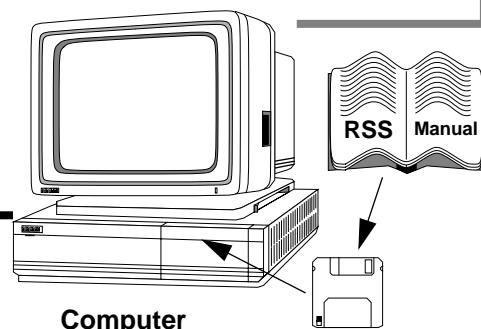
**RLN4008
(RIB)**

25 PIN

HKN9857

Programming / Test cable.

Connects between the RIB and radio.



Computer

**RVN4150A for GTx or LTR
RVN4156A for LTS 2000**

Software

**GTX/ GTx LTR/
LTS 2000 Radio**

Power Supply (7.5 Vdc)

Note: Battery can be used on programming cable making power supply optional.

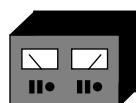


Figure 2. Equipment Setup

Configuring the RIB and Radio

1. Connect the RIB to the computer (Figure 2).
2. Plug the large 25-pin end of the HKN9857 programming cable into the RIB. The other end of this cable has a "battery eliminator."
3. Slide the battery eliminator in place of the radio's battery.
4. Plug power supply 0180357A57 (120 Vac) or 0180358A56 (220 Vac) into a wall outlet, and connect the other end to the RIB.
5. Connect the radio to a power supply and turn the volume control clockwise to turn it on.

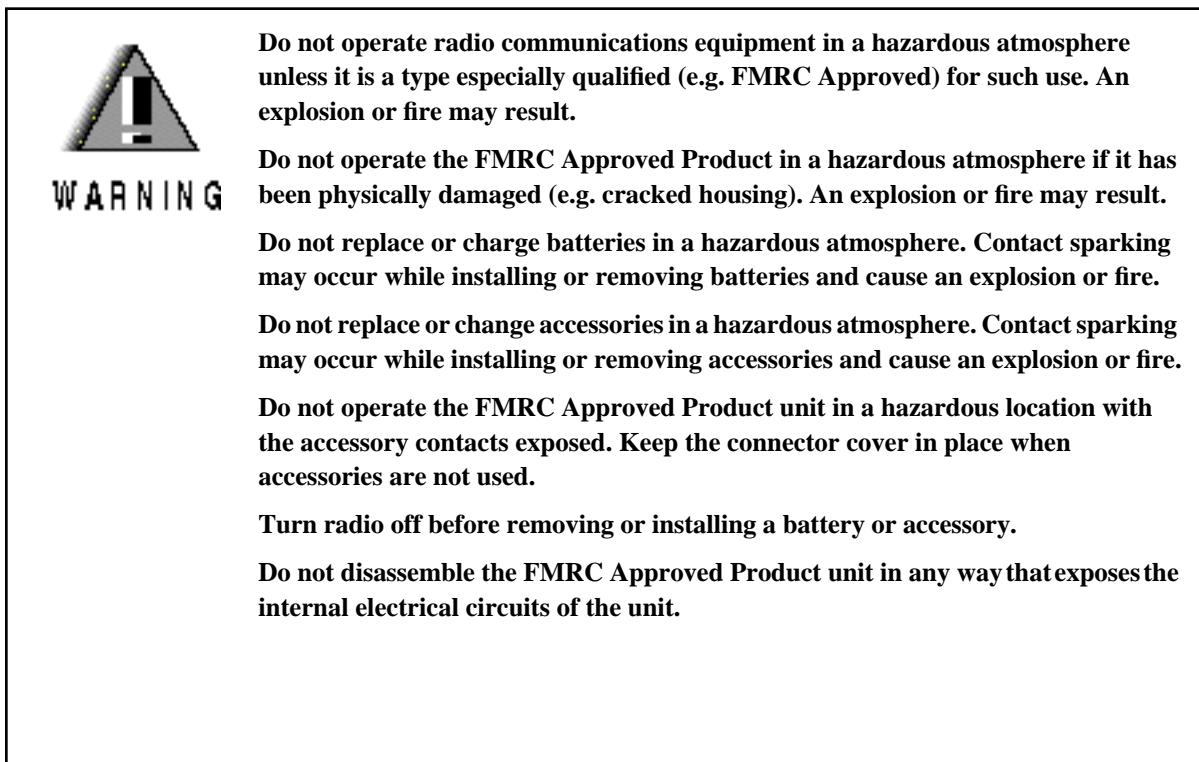
Important Safety Information: Intrinsically Safe Radios

FMRC Approved Equipment

Anyone intending to use a radio in a location where hazardous concentrations of flammable material exist (hazardous atmosphere) is advised to become familiar with the subject of intrinsic safety and with the National Electric Code NFPA 70 (National Fire Protection Association) Article 500 (hazardous [classified] locations).

An Approval Guide, issued by Factory Mutual Research Corporation (FMRC), lists manufacturers and the products approved by FMRC for use in such locations. FMRC has also issued a voluntary approval standard for repair service ("Class Number 3605").

FMRC Approval labels are attached to the radio to identify the unit as being FM Approved for specified hazardous atmospheres. This label specifies the hazardous Class/Division/Group along with the part number of the battery that must be used. Their Approval mark is shown below.



Radios must ship from the Motorola manufacturing facility with the hazardous atmosphere capability and FM Approval labeling. Radios will not be "upgraded" to this capability and labeled in the field.

Important Safety Information: Intrinsically Safe Radios

A modification changes the unit's hardware from its original design configuration. Modifications can only be done by the original product manufacturer at one of its FMRC audited manufacturing facilities.

**WARNING**

Failure to use an FMRC Approved Product unit with an FMRC Approved battery or FMRC Approved accessories specifically approved for that product may result in the dangerously unsafe condition of an unapproved radio combination being used in a hazardous location.

Unauthorized or incorrect modification of an FMRC Approved Product unit will negate the Approval rating of the product.

Repair of FMRC Approved Products

REPAIRS FOR MOTOROLA FMRC APPROVED PRODUCTS ARE THE RESPONSIBILITY OF THE USER.

You should not repair or relabel any Motorola manufactured communication equipment bearing the FMRC Approval label ("FMRC Approved Product") unless you are familiar with the current FMRC Approval Standard for repair service ("Class Number 3605").

You may want to consider using a repair facility that operates under 3605 repair service approval.

**WARNING**

Incorrect repair or relabeling of any FMRC Approved Product unit could adversely affect the Approval rating of the unit.

Use of a radio that is not intrinsically safe in a hazardous atmosphere could result in serious injury or death.

FMRC's Approval Standard Class Number 3605 is subject to change at any time without notice to you, so you may want to obtain a current copy of 3605 from FMRC. Per the December, 1994 publication of 3605, some key definitions and service requirements are as follows:

Repair

A repair constitutes something done internally to the unit that would bring it back to its original condition Approved by FMRC. A repair should be done in an FMRC Approved facility.

Items not considered as repairs are those in which an action is performed on a unit which does not require the outer casing of the unit to be opened in a manner which exposes the internal electrical circuits of the unit. You do not have to be an FMRC Approved Repair Facility to perform these actions.

The radio support center is at the following address:

Motorola Radio Support Center
3651 South Central Avenue

Rockford, Ill, 61102

Telephone: (800) 227-6772
(815) 489-1000

Relabeling

The repair facility shall have a method by which the replacement of FMRC Approval labels are controlled to ensure that any relabeling is limited to units that were originally shipped from the Manufacturer with an FM Approval label in place. FMRC Approval labels shall not be stocked by the repair facility. An FMRC Approval label shall be ordered from the original manufacturer as needed to repair a specific unit. Replacement labels may be obtained and applied by the repair facility providing satisfactory evidence that the unit being relabeled was originally an FMRC Approved unit. Verification may include, but is not limited to: a unit with a damaged Approval label, a unit with a defective housing displaying an Approval label, or a customer invoice indicating the serial number of the unit and purchase of an FMRC Approved model.

Do Not Substitute Options or Accessories

The communications equipment package that Motorola submits to FMRC for testing and approval is tested as a system that consists of the communications unit itself and the battery, antenna and other options or accessories that make up the rest of the package to be approved. This approved package must be strictly observed and there must be no substitution of items, even if the substitute you wanted to consider appears as an approved accessory elsewhere in the Guide for some other communications equipment unit. Approved configurations are listed by FMRC Approved Product in the annual Approval Guide published by FMRC. That guide, and the Approval Standard Class Number 3605 document, can be ordered from the following address.

Training Resource Center, Publications-Order Processing Dept.

Factory Mutual Engineering and Research

1151 Boston-Providence Turnpike

PO Box 9102

Norwood, MA, 02062

Telephone: (617) 762-4300

Vehicles Equipped with Air Bags

When planning the installation of communication equipment in a vehicle with one or more air bags, proceed as follows:



Vehicles equipped with air bags.

An air bag inflates with great force. DO NOT place objects, including communication equipment, in the area over the air bag or in the air bag deployment area. If the communication equipment is improperly installed and the air bag inflates, this could cause serious injury.

- Installation of vehicle equipment should be performed by a professional installer/technician qualified in the requirements for such installations. An air bag's size, shape and deployment area can vary by vehicle make, model and front compartment configuration (e.g., bench seat vs. bucket seats).
- Contact the vehicle manufacturer's corporate headquarters, if necessary, for specific air bag information for the vehicle make, model and front compartment configuration involved in your communication equipment installation.

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Section 1

Radio Disassembly/Assembly

Overview

This section explains, step by step, how to disassemble and reassemble the GTX/GTX LTR/LTS 2000 radios.

Safety Information

When testing and repairing the GTX/GTX LTR/LTS 2000 radios, observe the handling precautions to prevent unnecessary damage to the GTX/GTX LTR/LTS 2000 radios.

- Minimize handling of static-sensitive components and modules.
- Transport and store static-sensitive components or assemblies in their original containers on a metal rail. Label any package that contains static-sensitive components or assemblies.
- Discharge static electricity from the body by wearing a grounded antistatic wrist strap while handling these components. Servicing static-sensitive components or assemblies should only be done at a static-free work station by qualified service technicians. Increasing the humidity in the work area minimizes static electricity problems.
- Do not allow anything that can generate or hold a static charge on the workstation surface.
- Keep the component leads shorted together whenever possible.
- Pick up components by their bodies. Never pick them up by their leads.
- Do not slide the components over any surface.
- Avoid handling components in areas with a floor or work surface covering that can generate a static charge.
- Use a soldering iron connected to earth ground.
- Use only approved, anti-static, vacuum-type desoldering tools for removing components.
- When removing printed circuit boards (PCBs), remove the screws in a diagonal pattern to reduce stress on the boards.

Radio Disassembly

Battery Removal

1. The battery latch is located at the bottom of the radio (Figure 1-1). Press and hold the battery latch towards the front of the radio.

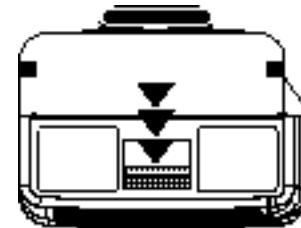


Figure 1-1. Press Battery Latch

2. Press the battery housing against the radio, while sliding the battery housing down until it is free of the chassis rails (Figure 1-2).

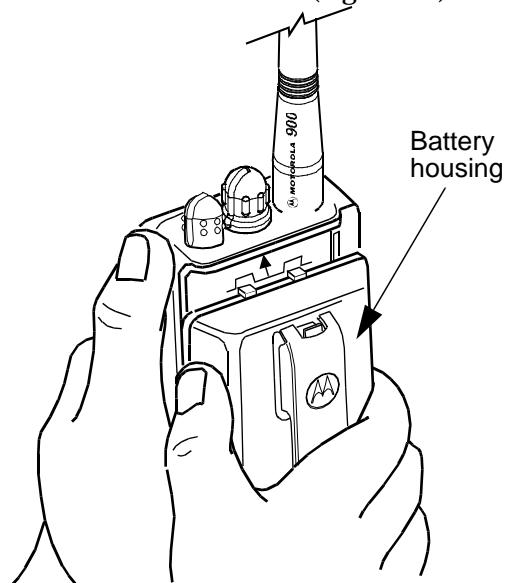


Figure 1-2. Slide Battery Housing

3. To remove the battery, pull it straight out and away from the radio.

Chassis Removal

1. Pull the control knobs straight off.

Radio Disassembly

2. Unscrew the antenna counter-clockwise until it is detached from the radio.
3. Carefully pry the chassis up on both sides, near the bottom, with a flat blade screwdriver (Figure 1-3).

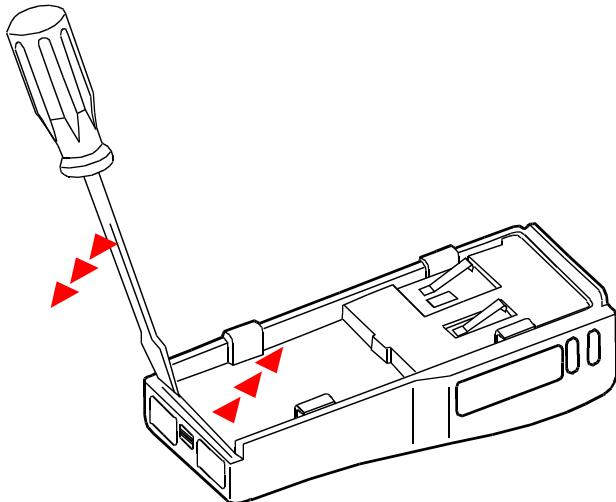


Figure 1-3. Remove Chassis

6. Pull the chassis out and away from the housing as shown by the arrow (Figure 1-4) and beware of the front cover flexible circuit.
7. Remove the flexible circuit using a flat-blade screwdriver or manually unlatching the ZIF connector (Figure 1-5).

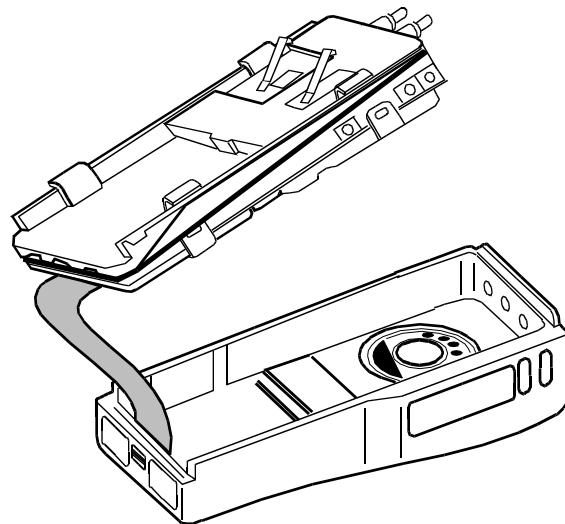


Figure 1-5. Unlatching Zif Connector

4. Lift the chassis approximately halfway out.

IMPORTANT

You must disconnect the ribbon cable before completely removing the chassis.

5. Remove the ribbon cable connector from the main board using pliers or a flat blade screwdriver (Figure 1-4).

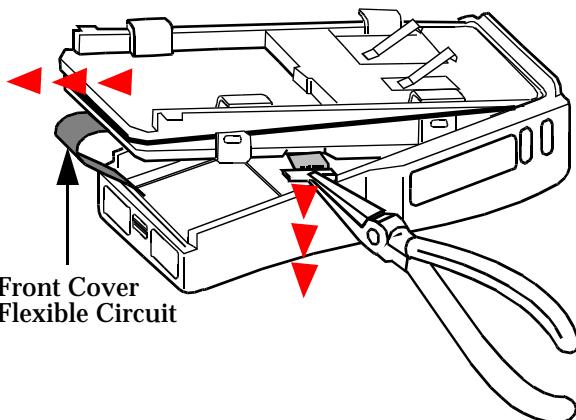


Figure 1-4. Remove Ribbon Cable Connector

Main Board Removal

The front shield holds the main board onto the chassis. To remove the front shield:

1. Place radio, chassis side down, on a flat surface.
2. Apply downward pressure to chassis directly above one of the clips opposite PTT switch.
3. With a flat blade screwdriver, carefully move clip away from tab on chassis to release.

NOTE
Remove both clips opposite the PTT switch first, to ease remaining clip removal.

4. Repeat steps 2 and 3 for the remaining three clips.
5. Separate the main board from the chassis (Figure 1-6).

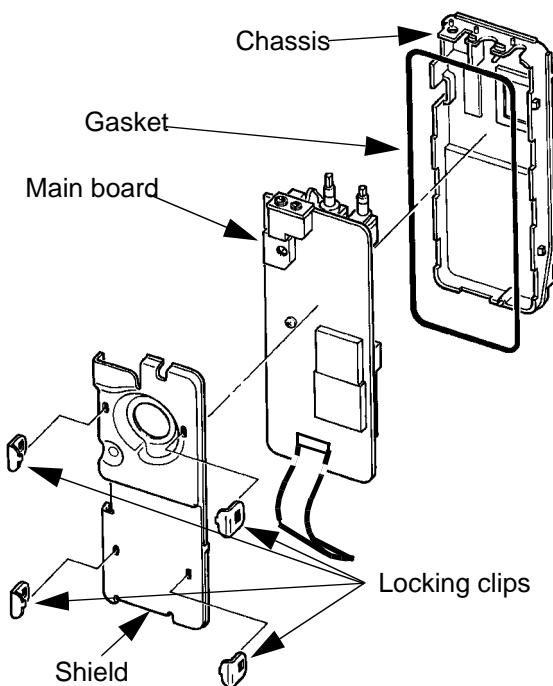


Figure 1-6. Separate Main Board From Chassis

6. Separate the flexible circuit tail by undoing the ZIF connector latch (Figure 1-7).

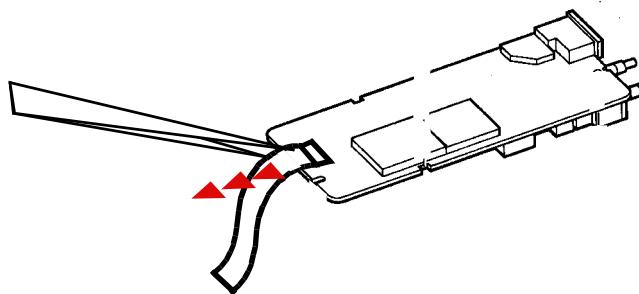


Figure 1-7. Separate Flexible Circuit Tail

Front Housing Board Removal

1. Place the front housing assembly with the front facing down on a padded flat surface. This is to avoid the lens from being scratched.
2. Remove the front housing shield using tweezers or sharp end screwdriver by undoing the four side catches (Figure 1-8).

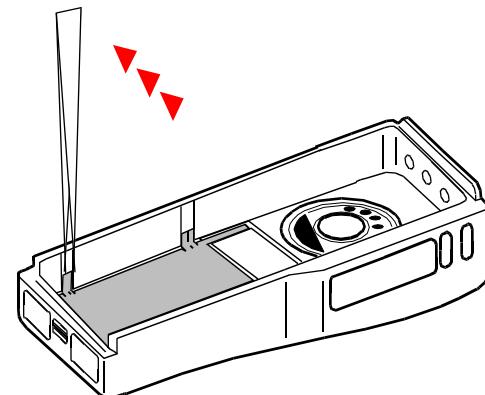


Figure 1-8. Remove Front Housing Shield

3. Separate the front housing board from the front housing.

Radio Reassembly

Front Housing Reassembly

1. Place the front housing on a cushioned flat surface with the front facing down.
2. Place the keypad into the front housing (Figure 1-9).
3. Place the board on the keypad in the housing (Figure 1-9).

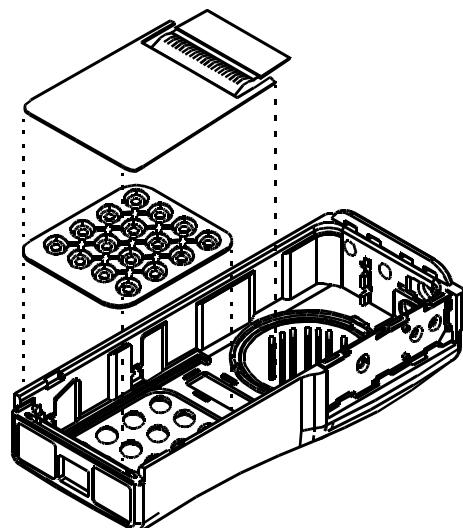


Figure 1-9. Place Keypad Into Front Housing

Radio Reassembly

- Fold the LCD flexible circuit (Figure 1-11). Make sure the LCD flexible circuit is outside.
- Place the front housing shield into the front housing using the four slots on the front housing wall as the guide (Figure 1-10).

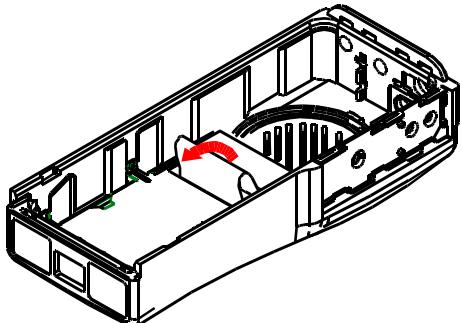


Figure 1-10. Place Front Housing Shield Into Front Housing

- Press down the shield at the four tabs until tabs lock into the front housing catches.
- Slide in the lightpipe (Figure 1-11).

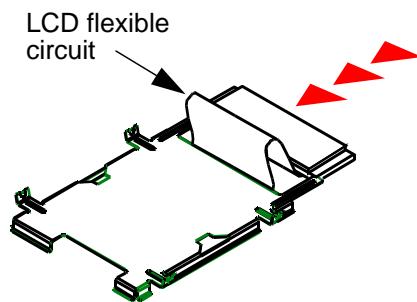


Figure 1-11. Slide In The Lightpipe

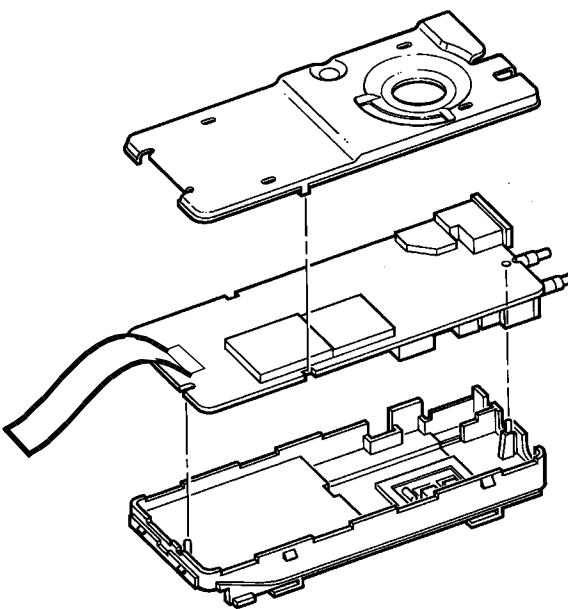


Figure 1-12. Align Pins

- Hook locking clips first to the chassis tab, then push clips over on shield with thumb until clips lock into front shield holes (Figure 1-13).

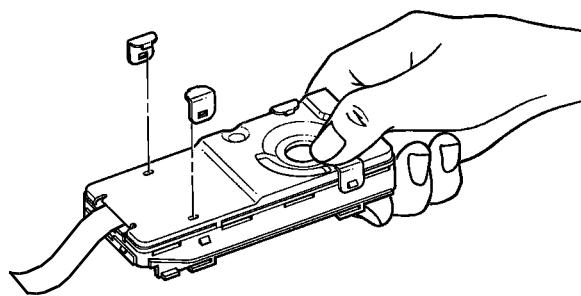


Figure 1-13. Reinsert Locking Clips

Chassis Reassembly

- Place chassis on a flat surface with the battery rails downward.
- Insert the flexible circuit tail end (marked "RF") into the ZIF connector on the RF board and lock the connector by engaging the latch (Figure 1-12).
- Insert main board into chassis using alignment pins as a guide (Figure 1-12).
- Place front shield on main board using tabs as a guide (Figure 1-12).
- Press down on front shield until chassis, main board, and front shield are seated tightly together.

- Replace chassis gasket (Figure 1-14).

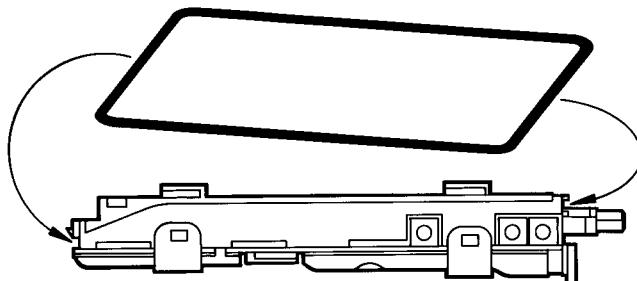


Figure 1-14. Replace Gasket

- Place the chassis assembly and front housing assembly on a flat surface with the top face of housing in a reverse and opposite direction (Figure 1-15)

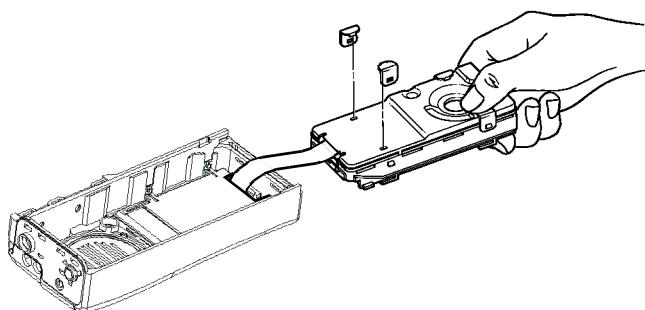


Figure 1-15. Place Chassis Opposite of Front Housing

Radio Reassembly

- Insert the flexible circuit tail from chassis to ZIF connector on front housing board. Lock the tail in the ZIF connector by pressing down the latch.

NOTE

Flexible circuit tail must be fully inserted to prevent short circuiting.

NOTE

The gasket helps keep the radio free from unwanted dirt, dust, and water. We recommend using a new lubricated gasket (part no. 3286063C01) when reassembling the radio. Using an old gasket could impair the overall seal quality of the radio.

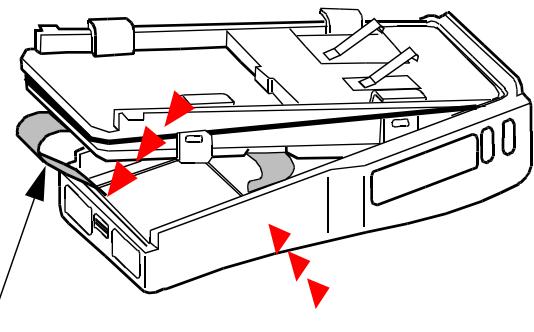
- Insert assembled chassis, main board, and front shield into radio housing at approximately a 45-degree angle (Figure 1-16). Exercise caution while inserting the volume

and frequency controls through the housing top.

IMPORTANT

The main board must be inserted into chassis (Step 3) before you can secure chassis into radio housing.

- Connect microphone/speaker ribbon cable.
- While pressing chassis toward the housing top, press the bottom end down into the housing until the bottom housing wall snaps over the chassis retaining studs.



Make certain that the flexible circuit is completely inside the housing.

Figure 1-16. Insert Chassis into Housing

NOTE

The chassis should snap firmly into place and the flexible circuit should be placed nicely **inside** the radio.

- Replace the knobs, antenna and battery.

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Section 2

Theory of Operation

Overview

This section provides a detailed theory of operation for the GTX/GTX LTR/LTS 2000 radios and its components: the receiver, transmitter, frequency generation circuitry, controller and audio & data circuitry.

Receiver

The receiver of the GTX/GTX LTR/LTS 2000 radios consists of 4 major blocks: the front-end module, double balanced mixer, 45.1 MHz IF, and back-end IF IC.

The GTX/GTX LTR/LTS 2000 front-end modules consist of three blocks of circuitry: a **ceramic pre-selector filter**, **RF amplifier** and **ceramic post-selector filter**.

The ceramic pre- and post-selector filters are 3-pole, bandpass filters. This topology maximizes the attenuation at the worst case image frequency for this receiver, which is 90.2 MHz below the filter Passband. The 3 dB bandwidth is approximately 12/22 MHz for 900 MHz respectively, centered at 937 MHz for 900 MHz respectively. The center of the band insertion loss is approximately 2 dB. The 3-pole filters are designed to operate with a 50 Ohm input and output termination.

The RF amplifier, Q1, is a Motorola MRF9411 NPN device biased in a common emitter configuration. The amp is stabilized by the shunt feedback coil L2, and has approximately 15 dB of gain with a noise figure of about 2 dB. The amplifier draws 6.5 mA of current and is supplied by the receiver 5 V supply (indicated as "5R" on the schematics and block diagrams).

Terminating the RF amplifier is the post-selector filter. This filter is the same as the pre-filter.

The net gain of the receiver front-end module is about 12 dB in the center of the band and about 11.5 dB at the band edges. The net center of the band noise figure is approximately 4.5 dB.

The receiver mixer is a double-balanced mixer which provides excellent protection against receiver spurs due to non-linearities, such as IM and half-IF. The received signal mixes down to the frequency of the first IF, 45.1 MHz, and enters the IF circuitry. The mixer operates with a LO level of +3 dBm and a conversion loss of about 7 dB.

Intermediate Frequency (IF)

The Intermediate Frequency (IF) section of the portable radio consists of several sections including the high IF, the second LO, the second IF, and the IF IC chip. The first LO signal and the RF signal mix to the IF frequency of 45.1 MHz, and then enters the IF portion of the radio.

The signal first enters the high IF, passes through a crystal filter, is amplified by the IF amp, and then passed through a second crystal filter. The first crystal filter provides selectivity, second image protection, and intermodulation protection. The amplifier provides approximately 16 dB of gain to the signal. The signal then passes through the second crystal filter which provides further selectivity and second image protection. The high IF has an approximate 3 dB bandwidth of 7 KHz.

The filtered and amplified IF signal is mixed with the second local oscillator at 44.645 MHz. The second LO uses an amplifier internal to the IF IC, an external crystal and some external chip parts. The oscillator presents an approximate level of -15 dBm to the second IF mixer, internal to the IF IC.

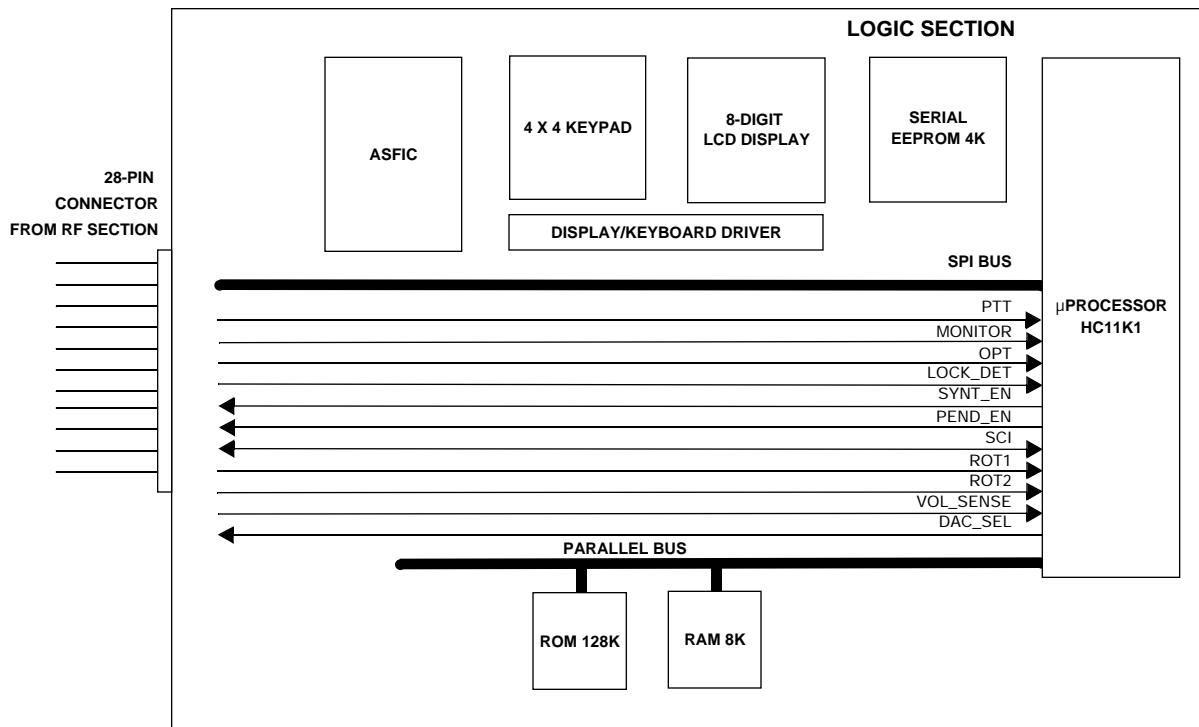
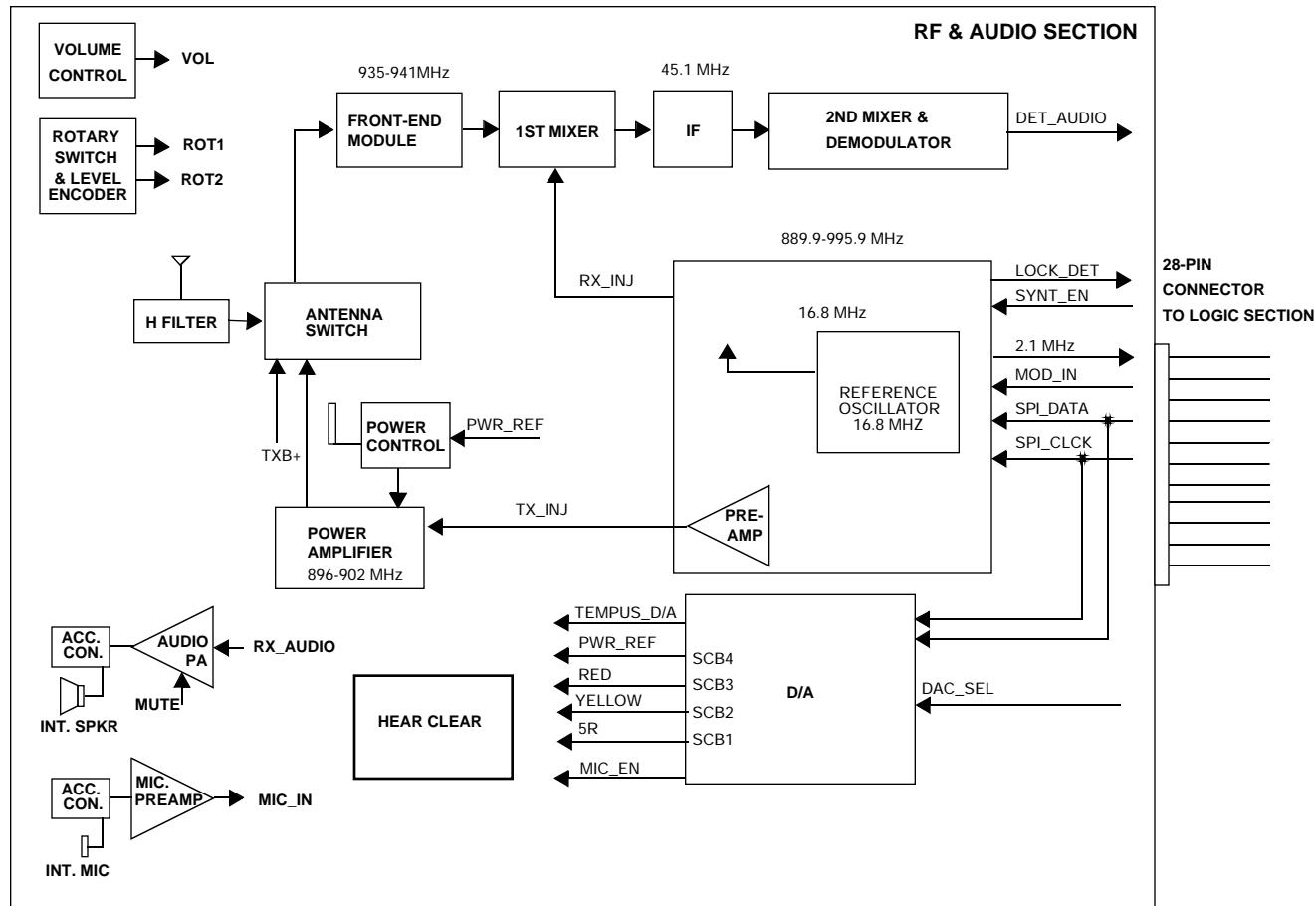
The mixed output of the IF signal and the second LO, produces a 455 KHz signal (second IF). This signal is then filtered by external ceramic filters and amplified. It is then passed back to the IF IC, sent to a phase-lock detector, and demodulated. The resulting detected audio output is then sent to the ASIFC to recover the audio.

Transmitter

The transmitter contains five basic circuits: a power amplifier, an antenna switch, a harmonic filter, an antenna matching network, and a power control. Refer to the block diagram and the schematic for more information.

The power amplifier is an LD-MOS module. This module contains a 3-stage amplification with a supply voltage at 7.5 V. The LD-MOS is capable of supplying an output power of 4.4 W with an input signal of 1 mW. The power output can be varied by changing the biasing voltage at the first stage.

Transmitter



RADIO FUNCTIONAL BLOCK DIAGRAM